Small (1-10 kW) vs. Large DG (100 kW+)

- Small is the way to go
- Do not currently have small systems with high reliability
- Premium niche markets are a plausible pathway to residential DG (long-term vision)
- System could do other things at home (more on this later)
- Benefits of 100 kW+ not as compelling compared to competing technologies

Near-Term Entry Markets

- Several applications would pay a premium for remote power, such as telecom (U.S. and developing countries) and data centers Who is willing to pay more now?
- Why are they willing to pay more?
  - Servicing gensets is expensive. Greater reliability, greater siting flexibility matters. This also enables new things, such as power for remote NG sensors.
- What are they willing to pay?
  - For continuous remote, you're competing against diesel gensets (can't run for a long time), and renewables + storage.
- What features do they care about?
  - Confidence that it works (other desired features listed at the end)

Tying to the Grid

- Providing flexibility to the grid very desirable
- Would be easier if utilities could own generation assets
- **Displacing peakers would reduce emissions and improve efficiency**
- Harder to compete with NGCC baseload in terms of efficiency

What an ARPA-E Project Would Need to do

- Types of projects
  - Seedling: $500k for 1 year
  - Full project: $1-8M for 3 years

- Would the output of one or both of these be sufficiently compelling that someone else would invest?
  - Challenge: there's not a broad materials base for this temperature range
  - New material development could be a seedling: show something at the cell-level.
  - For materials that have had some prior work, should create a 100 W stack. Would be nice if it's in a box, but a lab test stand also OK. 1,000 hours testing would be good.
  - Could also be Phased Program. Test new materials at cell level, then go to 100 W stack if something is promising.

Other Desirable Attributes

- Fuel flexibility
- Load-following capability / large turndown ratio
- Use DC output to charge EV
- Use off-peak renewables to create fuel
  - Electrolysis
  - Liquid fuels for high energy density
  - Use the CO2 that's generated to make fuel
- Not DG, but could use FCV for backup power at home